

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year)

22 November 2000 (22.11.00)

International application No.

PCT/GB00/00816

Applicant's or agent's file reference

DCM/ED/P10461PC

International filing date (day/month/year)

07 March 2000 (07.03.00)

Priority date (day/month/year)

10 March 1999 (10.03.99)

Applicant

DUNLOP, John et al

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

05 October 2000 (05.10.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO  
 34, chemin des Colombettes  
 1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38

# PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>DCM/ED/P10461PC</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/ 00816</b>	International filing date (day/month/year) <b>07/03/2000</b>	(Earliest) Priority Date (day/month/year) <b>10/03/1999</b>
Applicant  <b>UNIVERSITY OF STRATHCLYDE et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

### 1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of Invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

2

☐ None of the figures.

## INTERNATIONAL SEARCH REPORT

International Application No

P 00/00816

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04Q7/30

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 766 427 A (NOKIA MOBILE PHONES LTD) 2 April 1997 (1997-04-02) the whole document	1-6
X	KYUNG SU PARK ET AL: "A STUDY ON THE EFFECTIVE INTERCONNECTION METHOD BETWEEN BASE STATIONS AND SELECTOR BANK SYBSYSTEM IN CDMA BELLULAR NETWORKS" IEICE TRANSACTIONS ON COMMUNICATIONS, JP, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, vol. E78-B, no. 8, 1 August 1995 (1995-08-01), pages 1145-1151, XP000539749 ISSN: 0916-8516 figures 2A,2B	1-6



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

8 June 2000

Date of mailing of the international search report

15/06/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
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Authorized officer

Coppieters, S

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00816

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 537 411 A (PLAS PATRICK) 16 July 1996 (1996-07-16) abstract; figure 5 -----	1-3
X	US 5 550 898 A (OPLINGER THOMAS M ET AL) 27 August 1996 (1996-08-27) the whole document -----	1,2,4,5

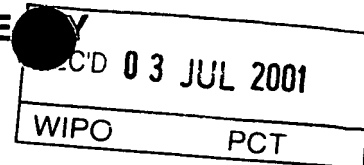
# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 00/00816

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0766427	A	02-04-1997	FI 954638 A	30-03-1997
			JP 9135479 A	20-05-1997
			US 5949775 A	07-09-1999
<hr/>				
US 5537411	A	16-07-1996	FR 2714559 A	30-06-1995
			DE 69408956 D	16-04-1998
			DE 69408956 T	29-10-1998
			EP 0660625 A	28-06-1995
			JP 7212375 A	11-08-1995
<hr/>				
US 5550898	A	27-08-1996	AU 655379 B	15-12-1994
			AU 5201393 A	09-06-1994
			CA 2109788 A	31-05-1994
			DE 69319697 D	20-08-1998
			DE 69319697 T	10-12-1998
			EP 0600681 A	08-06-1994
			ES 2118196 T	16-09-1998
			JP 6233345 A	19-08-1994
			SG 43148 A	17-10-1997
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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference DCM/SD/P10461PC		FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/00816	International filing date (day/month/year) 07/03/2000	Priority date (day/month/year) 10/03/1999	
International Patent Classification (IPC) or national classification and IPC H04Q7/30			
Applicant UNIVERSITY OF STRATHCLYDE et al.			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 8 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  05/10/2000	Date of completion of this report  29.06.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Delucchi, C  Telephone No. +49 89 2399 7305 

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00816

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

1-7 as originally filed

### Claims, No.:

1-6 as received on 02/03/2001 with letter of 02/03/2001

### Drawings, sheets:

1/2,2/2 as received on 31/03/2000 with letter of 31/03/2000

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00816

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Yes:	Claims	1-6
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-6
Industrial applicability (IA)	Yes:	Claims	1-6
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

## VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

## VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**



**Re Item V**

**Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Reference is made to the following documents:

**D1:** EP-A-0 766 427 (NOKIA MOBILE PHONES LTD) 2 April 1997 (1997-04-02)

**D2:** KYUNG SU PARK ET AL: 'A STUDY ON THE EFFECTIVE INTERCONNECTION METHOD BETWEEN BASE STATIONS AND SELECTOR BANK SUBSYSTEM IN CDMA CELLULAR NETWORKS' IEICE TRANSACTIONS ON COMMUNICATIONS, JP, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, vol. E78-B, no. 8, 1 Aug. 1995 (1995-08-01), p. 1145-1151, XP000539749 ISSN:0916-8516

**D3:** US-A-5 537 411 (PLAS PATRICK) 16 July 1996 (1996-07-16)

2. The present application does not meet the requirements of Article 33(1) PCT, because the subject-matter of **claim 1** does not involve an **inventive step** in the sense of Article 33(3) PCT.

2.1 **D1**, which is considered to be the closest prior art, discloses, according to the essential features of **claim 1**, a **mobile communications network** (office communication system including mobile phones; page 3, lines 29-33; cf. figure 2) comprising:

- a **local exchange** or **mobile switching centre (MSC)** effectively connected to a **plurality of cell site switches** (*gateway 1*; cf. page 6, lines 16-18, 37-38, page 7, line 15; extension to a plurality of gateways: page 6, lines 46-49),
- each cell site switch being effectively connected to a **cluster of base station transceivers** (*base stations BU 4, DECT FP 6 and IR 8*),
- wherein the connection between each cell site switch (*gateway 1*) and the respective cluster (*BU 4, DECT FP 6 and IR 8*) is formed by a **common bus** (*LAN*; cf. page 3, lines 31-33) to which each base station transceiver in the cluster and the pertaining cell site switch is directly connected (page 3, line 57 - page 4, lines 1 and 16-19),
- thus forming a hierarchical system in which resources can be allocated directly between the base station transceivers of their common cluster (page 6, lines 37-41, 50-55).

The subject-matter of **claim 1** differs from the disclosure of document **D1** only in that it further defines that **one base station transceiver** in the cluster acts as a **macro cell** and the **remaining base station transceivers** in the cluster act as **micro cells**.

However, these features are not considered to have any relevant technical effect and as with regard to the system according to **claim 1** and to add anything of **inventive significance** to the subject-matter of **claim 1**, the reasons for this being given in the following.

2.2 **D1** describes a system in which the *gateway computer 1* performs the same tasks as the cell site switch according to **claim 1** (page 9, lines 27-32)) and aims at solving the same technical problem, i.e. to reduce the load on the radio channels (increased due to the dynamic nature of resource allocation) and to reduce the signalling load in the local exchange, by providing the same solution as the present application, i.e. by integrating the base station transceivers using a common bus structure (*LAN*) between these base station transceivers (*BU 4*, *DECT FP 6* and *IR 8*) and the corresponding cell site switch (*gateway computer 1*) and creating a hierarchical structure in which the cell site switch can handle the handover situations without having to go through the MSC (page 6, lines 49-55).

**D1** acknowledges that ordinary communication networks consist of different kind of coverage cells, like **macrocells**, **microcells** and **umbrella cells** (page 8, lines 3-8), **but does not explicitly disclose** a system in which macro and micro cells are integrated in one cluster, since the system of **D1** mainly focuses on the office environment. In this office environment **nanocells** covering one or a few rooms of an office building are defined, which are a *miniaturized equivalent of the coverage areas of a base station BS in an ordinary cellular system* (cf. page 5, lines 15-17).

However, **D1** gives a hint of such an integration of different coverage cells. It discloses that the *home environment HE*, including a *home base unit 14 (HBU)* (cf. fig. 3), *forms a special nanocell for the terminals 5 in the home environment, which nanocell can be placed in the system hierarchy under the control of the gateway computer 1 in the office and thus in the same location as the base units in the office although it is located physically apart from them* (page 5, line 57 - page 6,

line 4). This is a clear indication to the fact that different cells can be expressly integrated under the same cell site switch, regardless of geographical viewpoints.

The selection defined in **claim 1** of having only **one macro cell** and **remaining micro cells** in the cluster is considered to fall within normal design measure obvious for a person skilled in the art.

As a result, the person skilled in art, departing from the disclosure of document **D1**, would use the teaching of **D1** about providing a common bus in order to allow dynamical resource allocation between base station transceivers, and with this, allow for a reduction in the signalling load in the systems. He would realize that the system of **D1** can be applied to the cellular communication system considered in the application, thus arriving at the solution defined by the subject-matter of **claim 1** without the exercise of inventive skills.

As a consequence, the subject-matter of **claim 1** lacks an inventive step (Article 33(3) PCT).

3. For the sake of completeness, the applicant's attention is drawn to the documents **D2** and **D3**, which are also considered relevant to be taken in combination with document **D1**, since they relate also to hierarchial systems using common bus structures as the one described in the application.

With regard to **D2**, this document discloses a CDMA interconnecting system to be applied in cellular networks and based on a common bus structure DQDB (cf. figures 2a, 2b) that interconnects base station transceivers BTS to other subsystems e.g. the base station manager BSM and the mobile telephone exchange MTX (via selector bank subsystem SBS). The object of such a common bus structure is the same as described in the present application, i.e. to allow the base stations to share channel bandwidth dynamically (page 1145, lines 25-30), this resulting in an efficient resource allocation and in a reduced signalling load in the local exchange.

In respect of **D3**, this document discloses a ring access network for a mobile radiotelephony network (col. 1, lines 7-8) formed by a dual bus, e.g. a DQDB, to

which are connected several base stations and an access point (cf. col. 2, lines 36-43; figure 2). The object of such a structure is the same as described in the present application, i.e. to avoid a star-shaped architecture that makes impossible the direct communication between the base stations or between the BSCs (col 2, lines 3-8) as well as the sharing of resources among the different ends of the star (col 2, lines 13-17).

4. **Dependent claims 2-6** do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty and inventive step, the reasons being as follows:

**Claims 2-3 and 5-6** define only features related to the common buses, these features being already known e.g. from **D1** and **D2**.

**Claim 4** merely extends the concept of a common bus to the interconnection of the higher level interface between the local exchange 24 and the cell site switch 22. This extension is considered obvious, since the possibility of applying the concept of a common bus to different levels in the network is explicitly addressed in **D3** (col. 2, lines 3-8).

**Re Item VII**

**Certain defects in the international application**

1. Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents **D1**, **D2** and **D3** is not mentioned in the description, nor are these documents identified therein.
2. **Claim 1** is not in the two-part form in accordance with Rule 6.3(b) PCT with those features known in combination from the prior art (document **D1**) being placed in the preamble (Rule 6.3(b)(i) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

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International application No. PCT/GB00/00816

**Re Item VIII**

**Certain observation in the international application**

1. The wording "...***thus*** forming a hierarchial system in which resources can be allocated..." of **claim 10** (lines 15-17) should have been avoided, since it defines the invention by a result to be achieved, underlying the technical problem instead of defining the technical features hereof (cf. PCT Guidelines, Section IV, III-4.7).

ART 34 ANN I

CLAIMS

1. A mobile communications network (20) comprising a local exchange (24), or mobile switching centre, effectively connected to a plurality of cell site switches (22) each cell site switch (22) being effectively connected to a cluster (14) of base station transceivers (13) with one base station transceiver (13) in the cluster (14) acting as a macro cell (13A) and the remaining base station transceivers (23) in the cluster (14) acting as micro cells (13B), wherein the connection between each cell site switch (22) and the respective clusters (14) is formed by a common bus (21) to which each base station transceiver (13) in the cluster and the pertaining cell site switch (22) is directly connected, thus forming a hierarchial system in which resources can be allocated directly between the base station transceivers (13A), (13B) of their common cluster (14).
2. A mobile communications network as claimed in claim 1, wherein the common bus (21) interconnecting each cell site switch (22) and the respective cluster (14) is a generic transmission medium.
3. A mobile communications network as claimed in claim 2 wherein the generic transmission medium is a local area network.
4. A mobile communications network as claimed in any preceding claim, wherein the connection between the local exchange (24) or mobile switching centre and the plurality of cell site switches (22) is formed by a further common bus (23) to which each cell site switch (22) and the local exchange (24) or mobile switching centre is directly connected.

5. A mobile communications network as claimed in claim 4, wherein the further common bus (23) is a generic transmission medium.

5 6. A mobile communications network as claimed in claim 5, wherein the further common bus (23) is a distributed queue dual bus network.

add a5

1/2

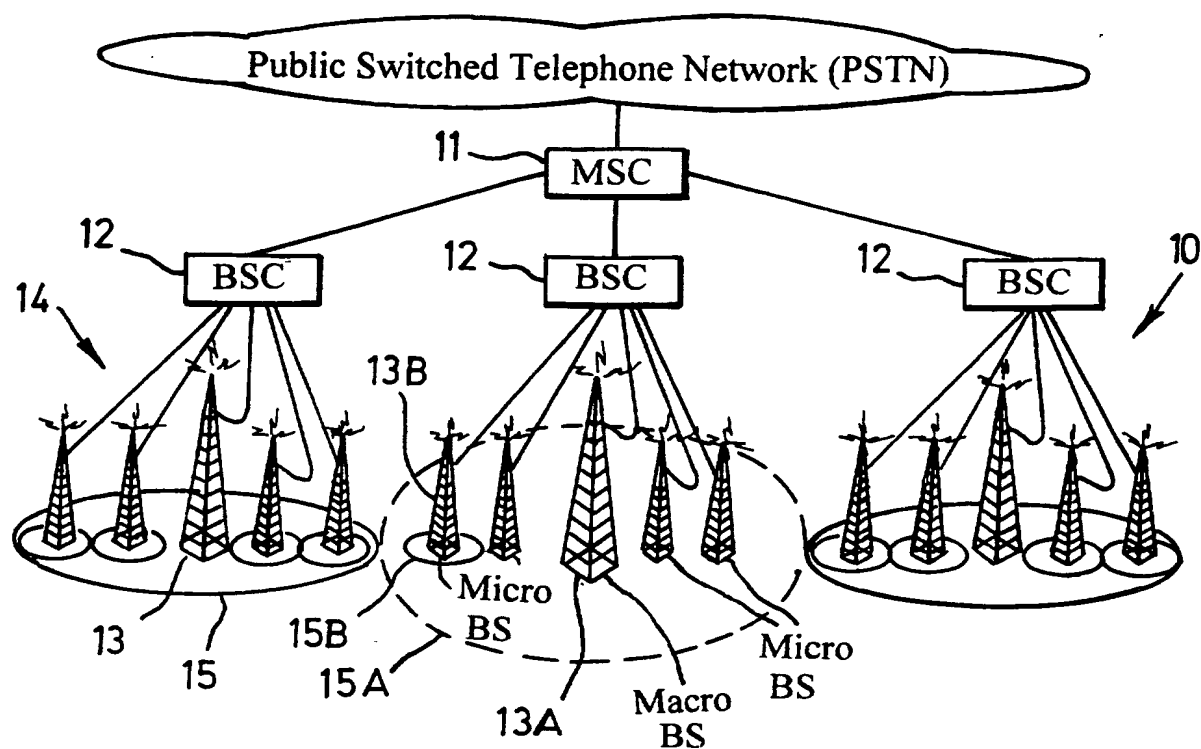


Fig. 1

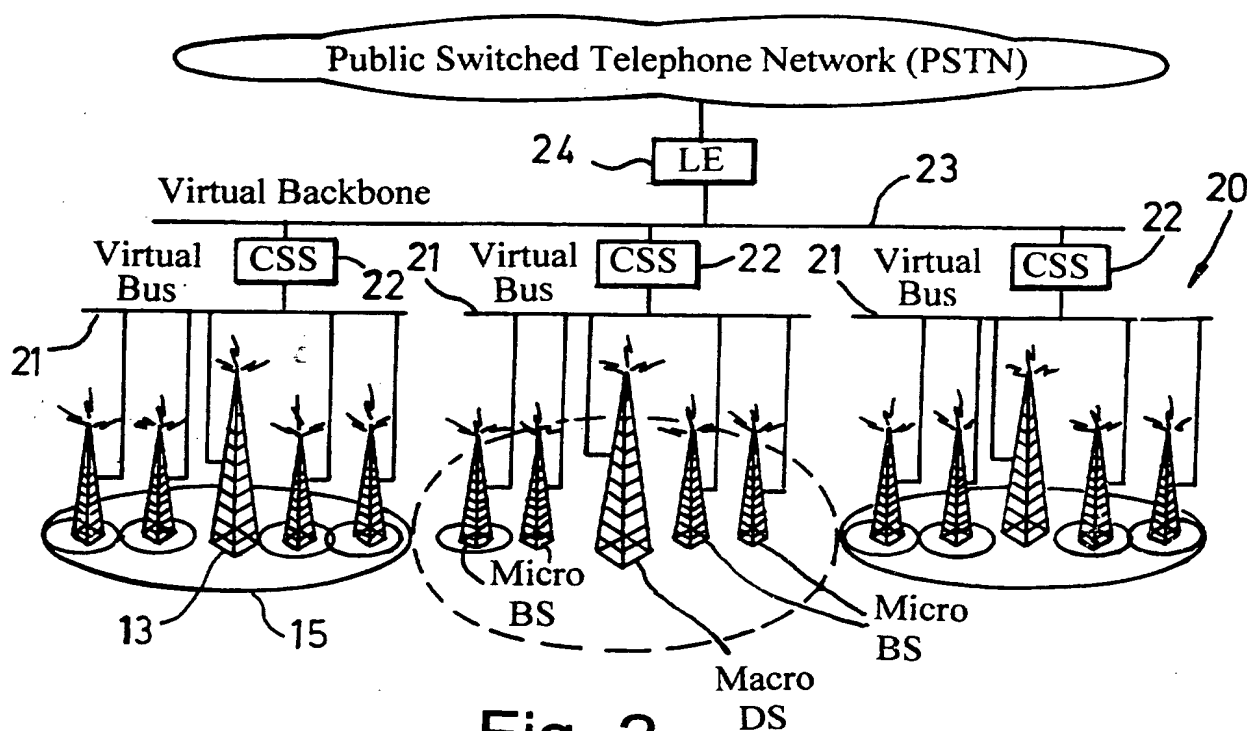


Fig. 2



ART 34 AMDT

2/2

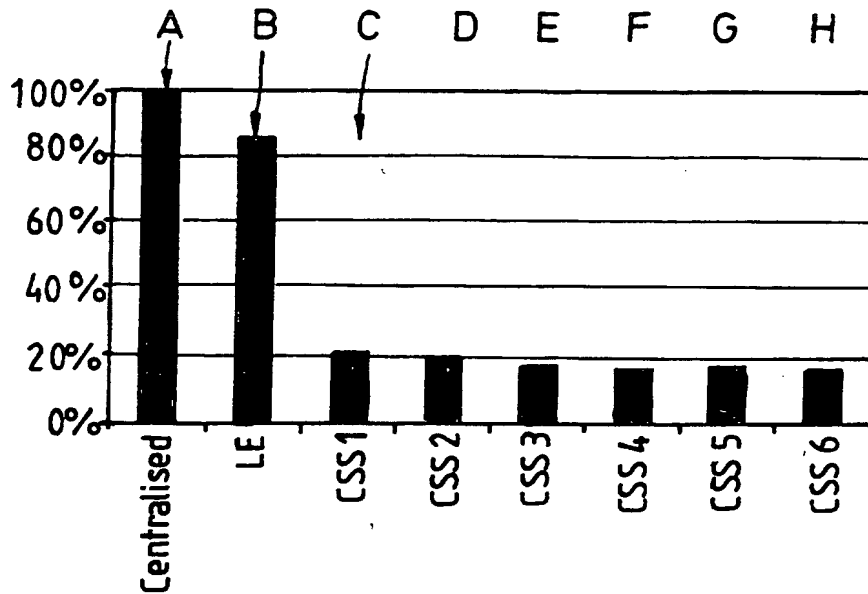


Fig. 3

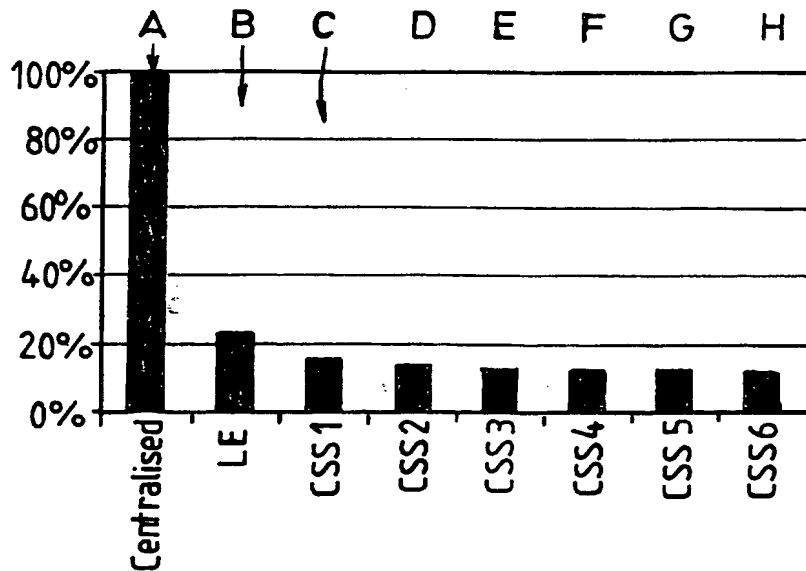


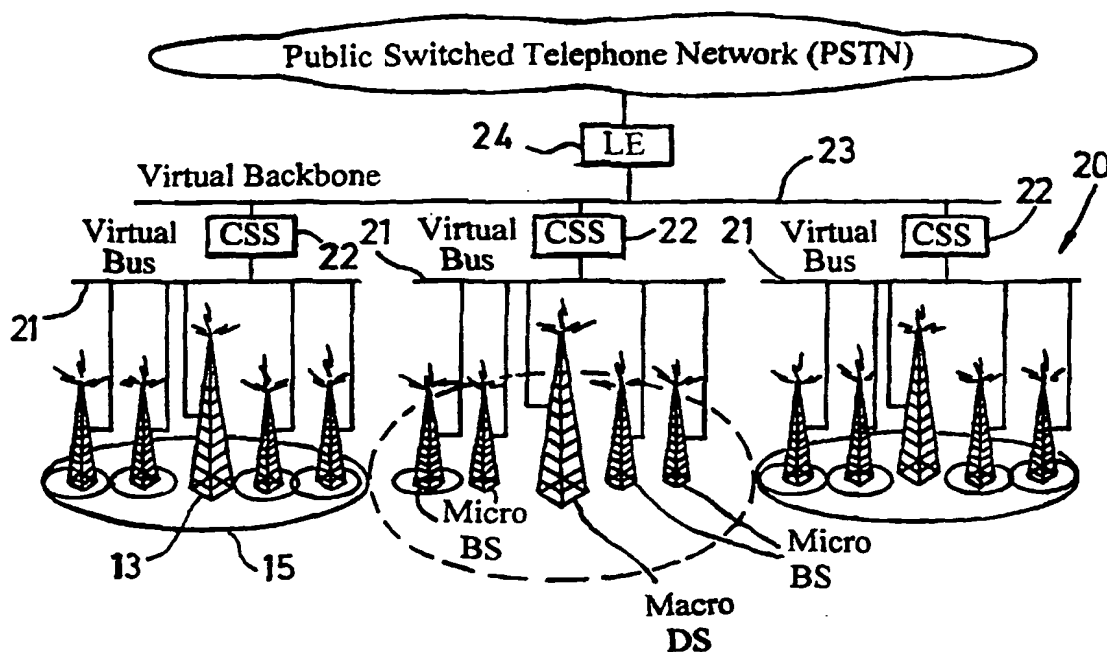
Fig. 4



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : <b>H04Q 7/30</b>	<b>A1</b>	(11) International Publication Number: <b>WO 00/54527</b> (43) International Publication Date: 14 September 2000 (14.09.00)
(21) International Application Number: PCT/GB00/00816 (22) International Filing Date: 7 March 2000 (07.03.00) (30) Priority Data: 9905372.0 10 March 1999 (10.03.99) GB (71) Applicant (for all designated States except US): UNIVERSITY OF STRATHCLYDE [GB/GB]; McCance Building, 16 Richmond Street, Glasgow G1 1XQ (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): DUNLOP, John [GB/GB]; 28 Westermains Avenue, Kirkintilloch, Glasgow G66 1EQ (GB). IRVINE, James, Menzies [GB/GB]; Brandon House, 25A Bentick Drive, Troon KA10 6HX, Ayrshire (GB). GIRMA, Demessie [GB/GB]; 15 Pentland Drive, Bishopbriggs, Glasgow G64 1XS (GB). LE BODIC, Gwenael [FR/GB]; Flat 2/117, Berkeley Street, Charing Cross, Glasgow G3 7HR (GB). (74) Agents: MCCALLUM, William, Potter et al.; Cruikshank & Fairweather, 19 Royal Exchange Square, Glasgow G1 3AE (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published With international search report.

(54) Title: MOBILE COMMUNICATIONS NETWORK



## (57) Abstract

A mobile communications network (20) comprises a local exchange (24) or mobile switching centre effectively connected to a plurality of cell site switches (22), each cell site switch (22) being effectively connected to a cluster (14) of base station transceivers (13). The connection between each cell site switch (22) and the respective cluster (14) is formed by a common bus (21) to which each base station transceiver (13) in the cluster and the pertaining cell site switch (22) is directly connected.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

**MOBILE COMMUNICATIONS NETWORK**

The present invention relates to mobile communications networks and in particular to network architectures.

5 A typical mobile communications network architecture comprises a mobile switching centre which is connected to the public switched telephone network (PSTN), the mobile switching centre being connected individually to several base station controllers each of which is connected individually to several base station transceivers. Each  
10 base station transceiver is capable of radio communication with mobile communications users within a specific area known as a cell. Cells are normally grouped in clusters and the radio resources allocated to each cell within a cluster are fixed, this is known as fixed channel  
15 allocation. In high user density areas cells have a geographically small radio footprint and may be overlaid by a larger umbrella cell which is appropriate for high mobility users. Resources allocated to the umbrella cell are unavailable to the smaller cells which it overlays.  
20 In this architecture resource allocation and all the signalling associated with allocating resources is handled centrally by the mobile switching centre.

As demand for mobile communications increases the trend in network architecture is towards employing  
25 increased numbers of smaller cells known as micro cells (or pico cells) together with a macro cell with a base station transceiver having a geographically large radio footprint which overlaps the collective radio footprints of the micro  
30 cell base station transceivers. This allows low mobility users such as pedestrians to be allocated to micro (or pico) base station transceivers while high mobility vehicular users are allocated to the macrocell base station transceivers. In this case radio resources allocated to  
35 individual cells in a cluster are no longer fixed but may be allocated in a dynamic fashion based on allowable levels of interference to surrounding cells, this is known as

dynamic channel allocation. This requires measurement of interference levels on the air interface by mobiles and base station transceivers and negotiation for available resources between individual base station transceivers within a cluster. However, this has a number of disadvantages namely:

Because mobile stations contend for resources over the air interfaces there is an increased load on the radio channels due to the dynamic nature of resource allocation and the need to update interference measurements frequently;

Because base station transceivers negotiate for resources in a dynamic fashion this adds significant signalling load to the traditional network architecture.

It is an object of the present invention to provide a mobile communications network which obviates or mitigates the forementioned disadvantages.

It is a further object of at least one embodiment of the present invention to provide a mobile communications network which produces a fast broadcast signalling path between base station transceivers and which does not require use of the air interface.

This is achieved by integrating each cluster of micro cell base station transceivers and the associated macro base station transceiver using a common bus structure.

According to the present invention there is provided a mobile communications network comprising a local exchange or mobile switching centre effectively connected to a plurality of cell site switches, each cell site switch being effectively connected to a cluster of base station transceivers wherein the connection between each cell site switch and the respective cluster is formed by a common bus to which each base station transceiver in the cluster and the pertaining cell site switch is directly connected.

By virtue of the present invention the network is layered and a fast signalling path is provided per cluster between the base station transceivers of that cluster

thereby permitting improved allocation of the network resources by localising appropriate parts of the network signalling traffic. Furthermore, the base station transceivers negotiate for radio resources over the fixed network, rather than as a result of measurements over the air interface, by receiving or locking radio channels by transmitting a single signalling packet when all base stations are connected to the same common bus. This reduces the overall load on the radio channel and enables base station transceiver channel allocation on acknowledged reservations rather than on interference measurements.

Preferably the connection between the local exchange or mobile switching centre and the plurality of cell site switches is formed by a further common bus to which each cell site switch and the local exchange or mobile switching centre is directly connected.

An embodiment of the present invention will now be described by way of example with reference to accompanying drawings in which:

Figure 1 illustrates a known form of mobile communications network;

Figure 2 illustrates a mobile communications network in accordance with the present invention;

Figures 3 and 4 illustrates different performance characteristics for the Figure 1 and Figure 2 networks.

As is shown in Figure 1 a known form of mobile communications network 10 is connected to a public switched telephone network (PSTN). The network 10 includes a mobile switching centre 11 directly connected to the PSTN and directly connected individually to several base station controllers 12. Each controller 12 is directly connected to the individual base station transceivers 13 which form the cluster 14 for that controller 12. In each cluster 14 there is one macro base station transceiver 13A and several micro base station transceivers 13B. It will of course be understood that the network 10 in reality will be much larger than is illustrated but only three controllers 12

and associated clusters 14 are shown in the interests of clarity. Similarly only a small number of base stations 13 per cluster are shown in the interests of clarity. The micro base stations 13B have geographically small radio footprints denoted 15B whilst the macro base station 13A has a geographically large radio footprint denoted 15A. Each Mobile Switching Centre 11 incorporates a data base which stores information used, as will be explained, in the allocation of radio resources to mobile users.

Figure 2 illustrates an alternative form of mobile communications network 20 which is in accordance with the present invention. In the network 20 the base station transceivers 13 with their footprints 15 are as previously described. However, in each cluster 14 each base station transceiver 13 is connected to a common bus 21 and the bus 21 in turn is connected to a cell site switch 22 which incorporates a database and which performs functions previously performed by the controller 12 and the switching centre 11. In the illustrated arrangement because there are three clusters 14, there are three buses 21 and three cell site switches 22. The cell site switches 22 are each connected to a further common bus 23 to which is also connected a local exchange 24 which performs certain functions previously performed by the mobile switching centre 11. The local exchange 24 is directly connected to the PSTN to which other local exchanges will also be connected in a large scale system.

The terms Mobile Switching Centre (MSC), Local Exchange (LE) and Cell Site Switch (CSS) are generic terms in a mobile radio network and functionality will vary very significantly between one manufacturer and another. However, the terms are well understood in the mobile radio environment and it is not thought necessary to reference specific examples.

Each common bus 21 is referred to as a virtual bus being a generic transmission medium which conveniently is implemented as a local area network, for example, based on

but not restricted to the IEEE standard 802.3 bus specifications. Because all of the base station transceivers 13 within a cluster 14 are interconnected by the virtual bus 21 a fast signalling path is provided between these base station transceivers irrespective of their size, and resources can be allocated dynamically between them according to demand and for a mixture of services with reduced need for radio channel measurements in comparison to those required in network 10 of Figure 1. Accordingly the network 20 is particularly well suited to packet based communications.

The bus 23 is referred to a virtual backbone, also being a generic transmission medium but which is conveniently implemented as, but not restricted to, a distributed queue dual bus (DQDB) network based on the IEEE 802.6 specifications. Use of the virtual backbone 23 allows the localisation of signalling to specific virtual buses 21 and reduces the signalling load from the local exchange 24 in comparison to that required for the mobile switching centre 11 in the network 10 of Figure 1.

Generally, in mobile communications networks encompassing dynamic channel allocation it is known that the traffic for resource management signalling is very much greater (orders of magnitude greater) than that for mobility management. Resource management is the dynamic assignment of communication channels whilst mobility management involves the repeated registrations and de-registrations of a mobile user sequentially over a series of base station transceivers. Both resource management and mobility management utilise information held in databases maintained in the network.

Figure 3 illustrates database accesses for mobility management and comparing the network 10 of Figure 1 with the network 20 of Figure 2. Firstly for the network 10, because it is a centralised network, all accesses (i.e. 100%) go through the mobile switching centre 11 as shown at column A. Network 20, however, is not centralised and as



shown at column B only about 85% of the accesses require to go through the local exchange 24 with the remainder as shown at columns C to H being confined to the cell site switches 22 (in this example there are six such switches).

5           In the architecture of Figure 2 the data bases are distributed between each CSS (22) and the LE (24). Hence if a handover occurs between cells of the same grouping, signalling traffic is handled exclusively by the appropriate CSS (22). However, if handover is between  
10       cells of different groupings then two CSSs (22) and one LE (24) will be involved. Thus an overhead occurs in terms of the need to replicate signalling in two CSSs (22). Thus the total signalling appears to be more than 100%, however the LE (24) still has less signalling than the  
15       centralised equivalent MSC (11) of Figure 1.

          Figure 4 illustrates the data base accesses for resource allocation in a dynamic channel allocation environment and compares the network 10 of Figure 1 with  
20       the network 20 of Figure 2. Again column A shows that in the centralised network 10 all accesses (i.e. 100%) go through the mobile switching centre 11 but at column B only about 24% go through the local exchange 24 of network 20 with the remainder distributed as shown at columns C to H over the six cell site switches 22 of network 20. The  
25       fact that about 76% of resource allocation signalling traffic is confined to the local buses 21 is a major advantage of the network 20.

          In Figure 4 the total signalling again appears to be more than 100% and the explanation is similar to that for  
30       Figure 3 except that in this case a very much higher percentage of the resource allocation traffic will be localised. Only resources allocated to cells near the periphery of a grouping of cells will affect the interference levels in cells near the periphery of other  
35       groupings. Only under these circumstances will resource allocation traffic be carried by two CSSs (22) and one LE (24). The overhead is thus much less, although the total

traffic can still appear to be more than 100%. In this case the traffic carried by the LE (24) is about 25% of the traffic carried by the equivalent MSC (11).

5 The principal advantage of the present invention is that by interconnecting the system components via a bus structure efficient network control can be implemented. In particular, the present invention:

10 provides a broadcast mechanism for channel allocation and adaptive control of the radio interface which does not rely on channel measurements;

enables efficient algorithm implementation for localised channel allocation in cell clusters with umbrella cell overlays;

15 enables the partitioning of traffic based on speed of movement of mobiles to micro cells and macro cells, thereby increasing spectral efficiency;

provides a platform for incorporation of distributed intelligence and knowledge base; and

20 reduces the global signalling load on the network.

## CLAIMS

1. A mobile communications network (20) comprising a local exchange (24) or mobile switching centre effectively connected to a plurality of cell site switches (22), each cell site switch (22) being effectively connected to a cluster (14) of base station transceivers (13), wherein the connection between each cell site switch (22) and the respective cluster (14) is formed by a common bus (21) to which each base station transceiver (13) in the cluster and the pertaining cell site switch (22) is directly connected.
2. A mobile communications network as claimed in claim 1, wherein the common bus (21) interconnecting each cell site switch (22) and the respective cluster (14) is a generic transmission medium.
3. A mobile communications network as claimed in claim 2 wherein the generic transmission medium is a local area network.
4. A mobile communications network as claimed in any preceding claim, wherein the connection between the local exchange (24) or mobile switching centre and the plurality of cell site switches (22) is formed by a further common bus (23) to which each cell site switch (22) and the local exchange (24) or mobile switching centre is directly connected.
5. A mobile communications network as claimed in claim 4, wherein the further common bus (23) is a generic transmission medium.
6. A mobile communications network as claimed in claim 5, wherein the further common bus (23) is a distributed queue dual bus network.

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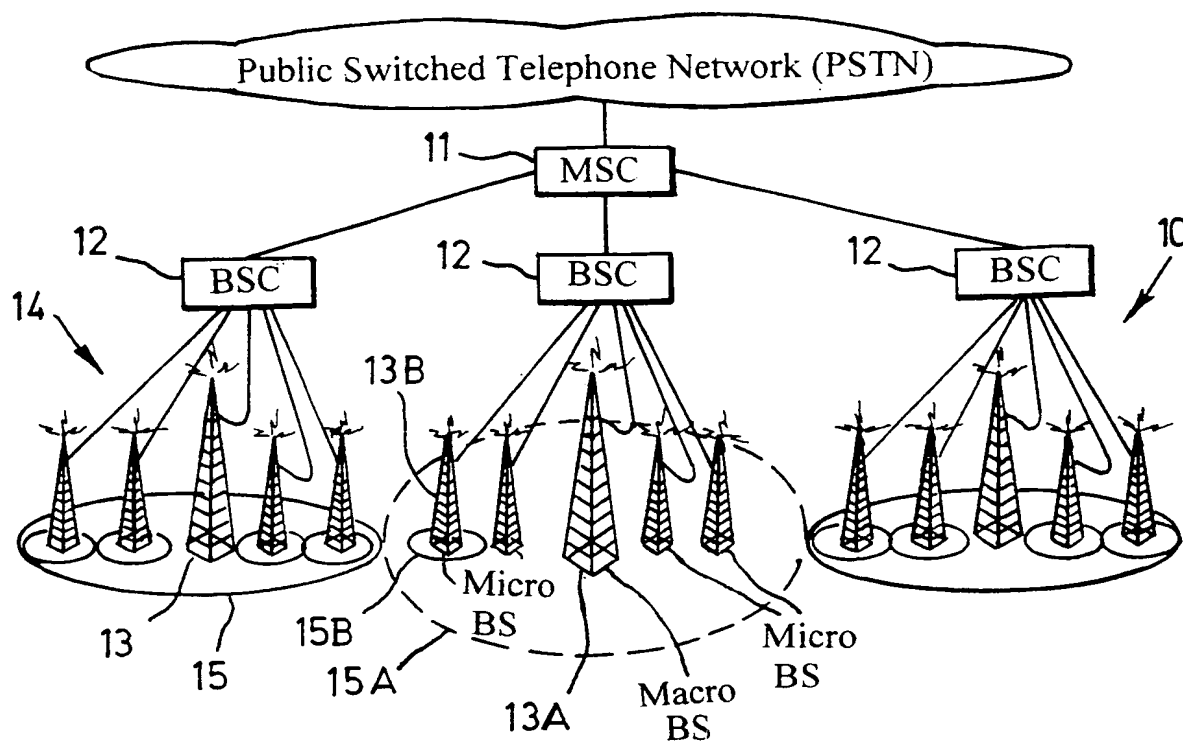


Fig. 1

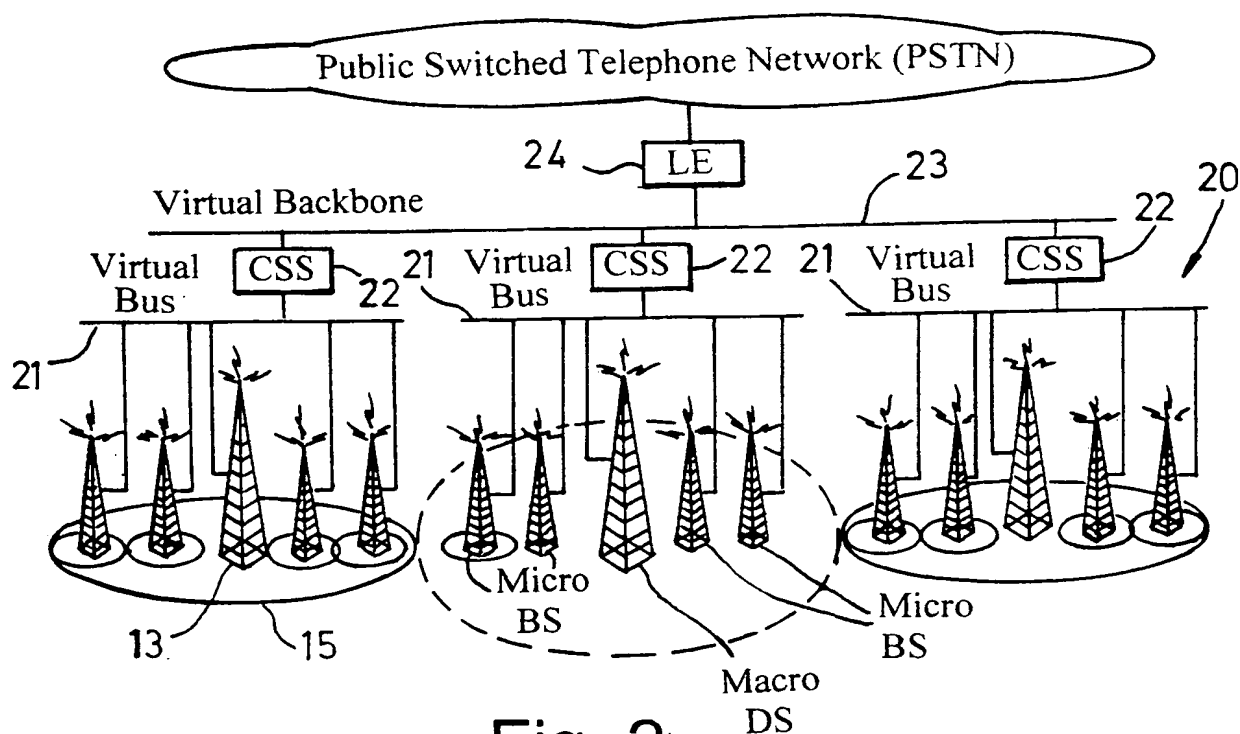


Fig. 2

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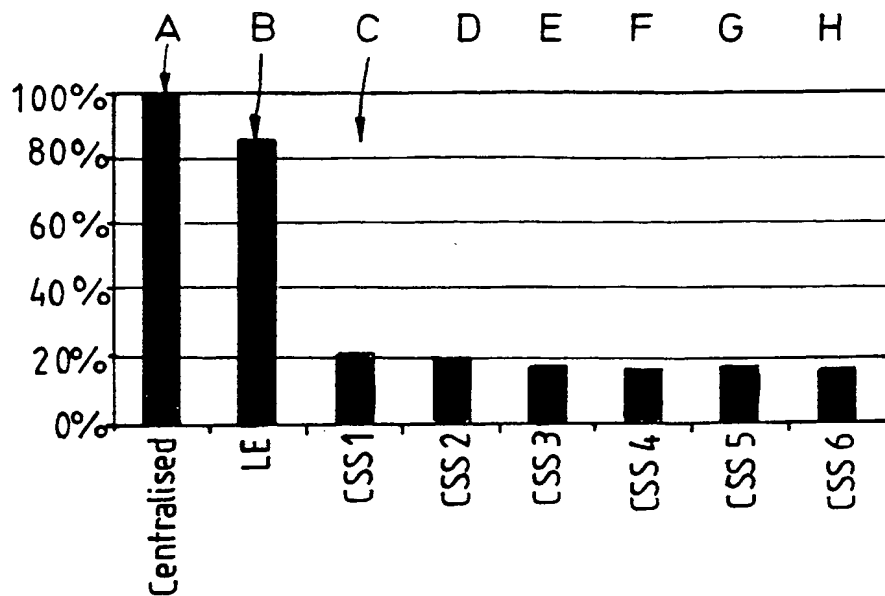


Fig. 3

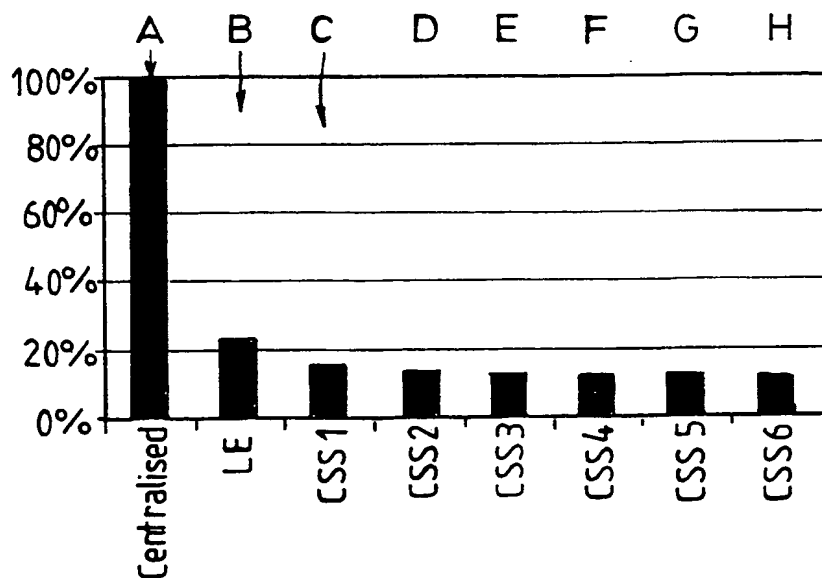


Fig. 4

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00816

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04Q7/30

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 766 427 A (NOKIA MOBILE PHONES LTD) 2 April 1997 (1997-04-02) the whole document	1-6
X	KYUNG SU PARK ET AL: "A STUDY ON THE EFFECTIVE INTERCONNECTION METHOD BETWEEN BASE STATIONS AND SELECTOR BANK SYBSYSTEM IN CDMA BELLULAR NETWORKS" IEICE TRANSACTIONS ON COMMUNICATIONS, JP, INSTITUTE OF ELECTRONICS INFORMATION AND COMM. ENG. TOKYO, vol. E78-B, no. 8, 1 August 1995 (1995-08-01), pages 1145-1151, XP000539749 ISSN: 0916-8516 figures 2A,2B	1-6



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents:

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Date of the actual completion of the international search

8 June 2000

Date of mailing of the international search report

15/06/2000

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00816

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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information on patent family members

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